General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

United States Department of the Interior

GEOLOGICAL SURVEY
EROS Data Center
Sioux Falls, South Dakota 57198

IN REPLY REFER TO: OAB3-23

February 27, 1985

Memorandum

To: Technical Officer

From: Principal Investigator AN 31

Subject: Quarterly Report: Landsat 4 Investigation of Thematic Mapper and Multispectral Scanner Applications (PCN902-91548; S-10757-C)

1) Problems

No problems occurred this quarter.

2) Accomplishments

a) A summary was prepared, and approved by NASA (Brian Markham) and Director of the U.S. Geological Survey, for presentation at the Final Results Symposium to be held in Indianapolis in October.

b) A small data base was organized and built to keep control of tapes acquired, processed and received for the project. This enables the 15 scientific collaborators and 3 co-investigators to have rapid access to their data as it is received.

c) Materials were prepared, mainly in 35mm slides, for presentation of investigator results at the ERIM symposium to be held in San Francisco in April (results summarized below).

3) Significant Results

Landsat 5 TM data collected over the Drum Mountains of western Utah on July 2, 1984, were digitally enhanced using band ratioing, principal components analysis, and spatial filtering techniques. Images produced by these techniques were analyzed and interpreted to extract as much geologic information as possible, and a geologic interpretation of the study area was developed on the basis of results of these image studies. Various enhanced TM images contributed to overall completeness and detail of the interpretation, especially with respect to structural and stratigraphic characteristics of the area. However, color-ratio-composite images, which include the TM 5/7 band ratio, proved most useful for distinguishing between and identifying exposures of hydroxyl-bearing, hydrothermally altered intrusive rocks and the closely associated, bleached contact metamorphic rocks that are dominated by calc-silicate mineral assemblages.

Interpretations of TM images of the Drum Mountains were compared with interpretations made from enhanced MSS data that were acquired simultaneously; the interpreted TM images were also compared with regional and detailed geologic maps and field evaluations. The amount and detail of geologic information interpreted from TM data is significantly greater than that available from MSS data. Additionally, the TM geologic interpretation more accurately portrays the geologic characteristics and setting of the central Drum Mountains than do all but the most detailed geologic maps of the area. Particularly for areas where vegetation cover is sparse, TM data are a valuable tool for geologic mapping.

Several subscenes of Landsat 5 TM data acquired over the Tonopah, Nevada, area on June 30, 1984, were selected to study hydrothermally altered areas known to contain a variety of alteration mineral assemblages. Images produced by digital enhancement techniques of these subscenes proved to be very effective in identifying and mapping hydrothermally altered rocks and also for discriminating and mapping unaltered rocks. The TM image enhancements most useful for identifying and mapping hydrothermal alteration and for distinguishing between altered and unaltered limonitic assemblages were color-ratio-composite images that include TM band ratios 5/7 and 3/1. In addition, the second principle component of a two-band image consisting of TM bands 5 and 7 proved to be useful for rapidly identifying areas believed to contain high concentrations of hydroxyl-bearing minerals.

Color-ratio-composite images produced from MSS data acquired over the Tonopah area at the same time as the TM data were used to identify and map high concentrations of limonite as well as other lithologic variation visible in the images. Comparison of the enhanced TM and MSS images verify the superior capabilities of TM data for providing information useful in mapping hydrothermal alteration and other lithologic variation. No only were MSS-based alteration interpretations improved by using TM data, but for most of the areas studied, lithologic variations in the unaltered rocks also were visible in more detail than shown on the preliminary 1:250,000-scale geologic map of the Tonopah quadrangle. TM data indeed represent a valuable source of geologic information, particularly in semi-arid regions such as much of the western United States.

4) Publications

Waltz, Frederick A., and Lauer, Donald T., Investigations of Thematic Mapper and Multispectral Scanner Data Applications, Summary for Presentation at ASP/ACSM Fall Convention, September 8-13, 1985, Indianapolis, Indiana.

5) Recommendations

None.

6) Data Utility

Problems of dropped lines, repeated lines and data shift occurred in the Warm Springs and Yakima data sets. This is evidently a problem in TIPS processing.

Donald T. Lauer